8. For reasons detailed, the primitive type of the mammalian lung is the symmetrical 'bilateral hyparterial' form, the symmetrical 'bilateral eparterial' form representing the *end-stage* in the process of evolution, not the *primary type* (Aeby, Wiedersheim).

9. The primitive type of division is practically dichotomous (*Hystrix, Taxidea*).

We can recognize two main trunks on each side, one cephalic, the other caudal. The cephalic trunk supplies the anterior and middle portions of the lung, the main migratory modifications in the different types taking place within its region of distribution. The caudal branch supplies the posterior and larger portion of the lung.

In the subsequent development of the stem-bronchus and its monopodic type of branching, characteristic of the majority of mammalian lungs, the following factors are active:

a. Complete segmentation of the primitive tracheal bulla, producing the usual bifurcation. This establishes the proximal portion of the stem-bronchus, and gives to the primary cephalic trunk the position of a lateral branch derived from the same.

b. The caudal continuation of the stem-bronchus is composed of the representative elements of the primary caudal trunk and its medial secondary branch, the lateral secondary branch and additional lateral accessory branches developed subsequently appearing as the 'ventral branches of the stem-bronchus' (Aeby).

c. The cardiac bronchus usually appears as a special accessory branch derived from the stem-bronchus of the right side only (Exception *Auchenia*).

10. In the majority of forms examined, the pulmonary artery is not dorsal to the stem-bronchus, except in the terminal portion. The position, as Narath has pointed out, is lateral or dorso-lateral.

11. Hence the distinction into 'dorsal' and 'ventral' branches, separated by the pulmonary artery in Aeby's sense, should be abandoned.

12. The results above outlined agree with the conclusions reached by Narath in regard to the equivalence of the anterior or cephalic branches of right and left side in asymmetrical lungs. They differ in the interpretation of the derivation of the 'Apical bronchus,' which he regards as the dorsal branch of the first ventral bronchus, and in the above outlined phylogenetic development of the stem-bronchus and its monopodic system of branching.

The conclusion of the paper deals with the probable causes which lead to the migratory changes in the relative position of the cephalic branches.

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SINGULAR STRESS-STRAIN RELATIONS OF RUBBER.

Since the stress-strain diagrams from rubber were published in this Journal of date of February 19th, last, the investigation has been somewhat extended. In all cases the same curious behavior was noted and the same peculiar differences compared with other materials. In all cases the substance behaved under load precisely as do other materials in the early part of its strain; then a reversed curve is described and the test-piece stiffens greatly and offers continually increasing resistance until, at last, rupture takes place, without yielding by inelastic deformation at any point in its course. Toward the end of its test the substance yields proportionately to the applied load. The fracture is sharp and without warning and the break clean and smooth and at right angles to the line of pull. No permanent reduction of section is observable after fracture. The reduced section immediately before breaking was

but one-eighth the initial section of the unstrained rubber.

Permanent set occurs to an exceedingly slight extent, and its value is dependent upon the maximum load and independent of the elastic properties of the substance. The set of the material would not be noticed in ordinary use. Permanent loads produce permanent, continuous, extension and, in time, fracture. This was found to be true for loads rising from 40 to 330 pounds per square inch (2.8 to 23.18 kgs. per sq. cm.), and stress-strain diagrams for two weeks under small loads showed steady elongation.

Plotting curves having for their coordinates loads per unit of area and areas of section of test-piece at point of maximum reduction, the stress-strain diagram thus produced becomes altered in form and similar to those of other materials plotted in the usual manner. It has the same curvature at the initial stage, the same straight line to an (apparent) elastic limit, and finally a steady, but slight, rise with increasing loads, with a sudden break at the end. The highest load measured in these experiments was 810 pounds per square inch (56.7 kgs. per sq. cm.). The quality employed, in all cases, was that of the stationers' elastic bands.

In this connection a recent article by Professor R. A. Fessenden has peculiar interest. He had noticed that, on making a fresh cut in a piece of rubber and then stretching it, using a microscope to reveal any peculiarities of appearance, the surface showed a curious sponge-like structure, with odd little excrescences gradually protruded, as the strain was increased, exuding from the pores of the substance. He thus indicates the existence in the material of two components: a hard and horn-like substance, and a jelly-like matter in its pores. He finds the same in other highly elastic substances. He offers a curious, but none-the-less notable, theory to account for the properties of this singular material.* The practically perfect elasticity exhibited in the experiments here described, as made in the Sibley College laboratories, lends confirmation to many of the ideas presented by that investigator, who indicated the form of the elastic curve for this curious substance in advance of its determination by experiment, and who based upon his theory of its construction explanations of its thermodynamic properties and actually produced, artificially, substances having similar elastic† properties.

R. H. THURSTON.
SIBLEY COLLEGE, CORNELL UNIVERSITY,
March 15, 1898.

BRADNEY BEVERLEY GRIFFIN.

THROUGH the untimely death of Bradney B. Griffin, who died on March 26th at the age of twenty-six years, zoology has lost an able student and a promising investigator. He was the son of Dr. Bradney Griffin, of New York, and received his earlier education at the College of the City of New York, where he graduated in 1894. Mr. Griffin then became a graduate student in zoology at Columbia University, where he subsequently won a fellowship and took part in the zoological expeditions to the northwest coast, sent out by that institution in the summers of 1896 and 1897. He was the author, wholly or in part, of several papers relating to the fauna of that region, one of which, dealing with the nemerteans of Puget Sound and describing a number of species new to science, had been sent to

*Journal of the Franklin Institute, September, 1896. See also Watts Dictionary, First Edition, Vol. II., p. 738—Caoutchouc.

†Thus: Sodium stearate, dissolved in 5 to 20 parts hot water and permitted to set as a jelly, gives, when cold, stress-strain diagrams like those of caoutchouc. When squeezed dry by hand, however, this compound becomes at once brittle and powdery. As a jelly it behaves like animal muscle in many ways and is polarized to electric waves.